

## **Four Year Undergraduate Programme**

**Department of Physics, Pandu College, Guwahati-12**

### **Programme Outcome**

Physics is one of the fields of information that underlies the physical universe. Studying for a physics degree will offer a student with profits which last a life time, awareness and skills. These skills are useful in many frameworks, for example, a practical approach to problem-solving, the ability to reason clearly and to interconnect well. Regarding the course it covers with a wide range of applicability of the subject about which everyone can feel and act. The theoretical and experimental knowledge makes a person logical and rational in every aspect in such a way that he used to justify things through facts and truthfulness. The program outcomes of a physics course in a four-year undergraduate degree program typically aim to equip students with a range of skills, knowledge, and abilities that prepare them for various career paths or further studies in physics or related fields. Certain subjects within the course have paved the way for higher studies and Research at different levels.

## **Four Year Undergraduate Programme**

### **Subject: Physics**

#### **Semester: First**

**Course Name: Mathematical Physics and Mechanics**

**Course level: PHY101**

#### **Course Outcome:**

*On successful completion of the course, students will be able to understand the calculus of vectors and concept of curved spaces which play central roles in developing insight of the theories of physics. They will learn the powerful method of computation through Dirac delta function which often appears in complex problems of physics. Students will be able to understand and apply the concepts of dynamics of particles, energy, oscillation and basic properties of matter in various problems of physics, technology and engineering. They will be trained in concept realisation through laboratory practices.*

#### **Semester: Second**

**Course Name: Mathematical Physics & Electricity and Magnetism**

**Course level: PHY151**

#### **Course Outcome:**

*After the successful completion of the course, students will be able to understand methods of solving various differential equations appearing in physics. It will give an idea of how to study evolution of a physical system. Through matrix algebra students will be able to compute various matrix operations which are required for solving physical problems. They will be able to understand electric field and magnetic fields in matter, dielectric properties of matter, magnetic properties of matter, application of Kirchhoff's law in different circuits, and application of network theorem in different circuits. The students will also get accustomed to using multimeters and potentiometers, and they will be able to determine some of the important physical quantities related to electricity and magnetism for a better understanding of the topic.*

**Semester: Third**

**Course Name: Waves and Optics**

**Course level: PHY201**

**Course Outcome:**

*On successful completion of the course students will:*

- 1. understand Simple Harmonic Oscillation and superposition principle.*
- 2. understand the classical wave equation in transvers and longitudinal waves and solutions of few physical systems on its basis.*
- 3. understand the concept of normal modes in transvers and longitudinal waves*
- 4. understand the interference as superposition of waves from coherent sources and also understand the basic principle of Young's double slit experiment, Fresnel's Biprism, Newton's Rings, Michelson interferometer etc.*
- 5. understand the basic concept of diffraction, Fresnel and Fraunhofer diffraction from a slit.*
- 6. understand the concept of polarisation of light, the production and detection of polarized light.*
- 7. understand working principle of prism, biprism, spectrometer, Newton's ring apparatus, grating, CRO, sodium and mercury light sources etc.*

**Semester: Four**

**Course Name: Classical Mechanics**

**Course level: PHY251**

**Course Outcome:**

*On successful completion of the course students will be able to apply the laws of classical dynamics to physical problems of motion of particles, systems of particles and fluids in various fields of physics and natural science as a whole. They will also get the exposure of the idea of how space and time play role in dynamics of matter.*

**Course Name: Quantum Mechanics 1**

**Course level: PHY252**

**Course Outcome:**

*On successful completion of the course students will be able to learn physical and mathematical fundamentals of Quantum physics, and various topics in it. These concepts are used in various branches of physics, like condensed matter physics, lasers, quantum statistics, atomic and molecular physics, particle physics, astrophysics and optics etc.*

**Course Name: Analog Electronics**

**Course level: PHY253**

**Course Outcome:**

On successful completion of the course, students will be able to understand the physics of semiconductor p-n junction and devices such as rectifier diodes, Zener diode, photodiode, etc.; they will understand the basics of bipolar junction transistors, transistor biasing, and stabilization circuits; the concept of feedback in amplifiers and the oscillator circuits. Students will also have an understanding of operational amplifiers and their applications.

**Course Name: Mathematical Physics**

**Course level: PHY254**

**Course Outcome:**

On successful completion of the course, the students will be equipped with the techniques related to solving partial differential equations using separation of variables method, application of Fourier series analysis, solving complex integrations, dealing with tensors and probability distributions which are relevant while dealing with wave mechanics, electrodynamics, quantum mechanics, theory of relativity and experimental physics.

**Semester: Five**

**Course Name: Atomic and Molecular Physics**

**Course level: PHY301**

**Course Outcome:**

Students will be able to describe the atomic spectra of one and two valence electron atoms and will also understand the change in behavior of atoms and corresponding modification of their spectra in external applied electric and magnetic field. They will understand the basic principle of pure rotational, vibrational, Rotation-Vibration and Raman spectra of molecules and their few applications.

**Course Name: Condensed Matter Physics**

**Course level: PHY302**

**Course Outcome:**

On successful completion of the course students will be able to acquire the basic knowledge of crystal structure, bonding in solids and elementary lattice dynamics of materials, dielectric, ferroelectric and magnetic properties of solids, the physics of

electrons in solids, basic idea about nanomaterials, thin film and soft matter and understand the basic concept in superconductivity.

**Course Name: Heat and Thermodynamics**

**Course level: PHY303**

**Course Outcome:**

Upon completion of this course, students will be able to learn thermal properties of gas molecules and their collisions. With this course, students will acquire knowledge of thermodynamics with practical insights into thermal physics, which will help them to understand real world situations.

**Course Name: Electromagnetic Theory**

**Course level: PHY304**

**Course Outcome:**

After the successful completion of the course, students will acquire the concepts of Maxwell's equations, propagation of electromagnetic (EM) waves in different homogeneous-isotropic as well as anisotropic unbounded and bounded media, production and detection of different types of polarized EM waves, general information of waveguides and fibre optics.

**Semester: Six**

**Course Name: Nuclear and Particle Physics**

**Course level: PHY351**

**Course Outcome:**

On successful completion of the course, the students shall be able to understand the structure and properties of a nucleus. They will also know about the properties of strong nuclear force that keeps the nuclei bound. They will learn about the radioactive decays and various laws of radioactive disintegration. Students will have adequate knowledge on the construction and working principles of particle accelerators and detectors. Moreover, students will be introduced to the world of particle physics – types and interactions. The acquired knowledge can be applied in the areas of nuclear medicine, medical physics, archaeology, geology and other interdisciplinary fields of Physics and Chemistry. It will enhance the special skills required for these fields.

**Theory Credit: 04 (Three)**

**Course Name: Digital Electronics**

**Course level: PHY352**

**Course Outcome:**

After successful completion of the course student will be able to develop, implement and analyze digital logic circuits and apply them to solve real-life problems and classify different semiconductor memories

**Course Name: Astronomy and Astrophysics**

**Course level: PHY353**

**Course Outcome:**

On successful completion of this course students will be able to understand the fundamental concepts in astronomy. They will be able to apply physics of celestial objects in understanding the universe. They will be equipped with the skills required for (i) observational astronomy (ii) virtual observatory tools and (iii) physical concepts of recent frontiers in astrophysics.

**Course Name: Statistical Mechanics**

**Course level: PHY354**

**Course Outcome:**

Upon completion of the course, students will get accustomed to the microscopic origin of thermodynamic processes. After successful completion of the course, students will be able to perceive classical and quantum pictures of physical and chemical events